

What is claimed is:

1. Composite oxide powder, comprising particles of a composite oxide of an oxide of a metal  $M_1$  and an oxide of a metal  $M_2$  which does not dissolve in said oxide of said metal  $M_1$ , said oxide of said metal  $M_1$  and said oxide of said metal  $M_2$  being dispersed at the nanometer level.

2. Composite oxide powder according to claim 1, wherein when microanalysis on one of said composite oxide particles not overlapped is carried out by means of energy dispersive X-ray spectrometry (EDS) using a field emission scanning transmission electron microscope (FE-STEM) with a beam of 5-nm diameter, said metal  $M_1$  and said metal  $M_2$  are detected at composition in  $\pm 20\%$  of charge composition at 90% or more of respective analytical points.

3. Composite oxide powder according to claim 1, wherein when microanalysis on one of said composite oxide particles not overlapped is carried out by means of energy dispersive X-ray spectrometry (EDS) using a field emission scanning transmission electron microscope (FE-STEM) with a beam of 0.5-nm diameter, said metal  $M_1$  and said metal  $M_2$  are detected at composition in  $\pm 20\%$  of charge composition at 90% or more of respective analytical points.

4. Composite oxide powder according to claim 1, further comprising:

particles of said oxide of said metal  $M_2$ ,

wherein a mixture in which said composite oxide particles and

said particles of said oxide of said metal  $M_2$  are dispersed at the level of not more than 50 nm being contained by 90% or more of the total weight of said composite oxide powder.

5. Composite oxide powder according to claim 1, wherein said metal  $M_1$  is Ce.

6. Composite oxide powder according to claim 1, wherein said metal  $M_2$  is at least one element selected from the group consisting of Al, Ti and Si.

7. Composite oxide powder according to claim 6, wherein said metal  $M_2$  is Al.

8. Composite oxide powder according to claim 1, wherein said oxide of said metal  $M_1$  is contained in an amount of 50 % or more of the total weight of said composite oxide powder.

9. Composite oxide powder according to claim 8, wherein said oxide of said metal  $M_1$  is contained in an amount of 75 % or more of the total weight of said composite oxide powder. 47

10. Composite oxide powder according to claim 1, further comprising an oxide of a metal  $M_3$  which can dissolve in at least one of said oxide of said metal  $M_1$  and said oxide of said metal  $M_2$ .

11. Composite oxide powder according to claim 10, wherein said metal  $M_3$  is at least one element selected from the group consisting

of Zr, alkaline earth metals and rare earth elements.

12. Composite oxide powder according to claim 5, wherein cerium oxide after calcination at 600 °C for 5 hours has a crystallite diameter of 5 to 10 nm, which is calculated from a half width of an X-ray diffraction peak of  $\text{CeO}_2$  (220).

13. Composite oxide powder according to claim 5, wherein cerium oxide after calcination at 800 °C for 5 hours has a crystallite diameter of 10 to 20 nm, which is calculated from a half width of an X-ray diffraction peak of  $\text{CeO}_2$  (220).

14. Composite oxide powder according to claim 5, wherein cerium oxide after calcination at 1000 °C for 5 hours has a crystallite diameter of 35 nm or more, which is calculated from a half width of an X-ray diffraction peak of  $\text{CeO}_2$  (220).

15. Composite oxide powder according to claim 1, wherein pores of 3.5 to 100 nm in diameter have a volume of 0.07 cc/g or more after calcination at 600 °C for 5 hours, and pores of 3.5 to 100 nm in diameter have a volume of 0.04 cc/g or more after calcination at 800 °C for 5 hours.

16. Composite oxide powder according to claim 1, wherein pores of 3.5 to 100 nm in diameter have a volume of 0.13 cc/g or more after calcination at 600 °C for 5 hours, and pores of 3.5 to 100 nm in diameter have a volume of 0.10 cc/g or more after calcination at 800 °C for 5 hours.

17. A method of producing said composite oxide powder recited in claim 1, comprising the steps of:

preparing an aqueous solution or water-contained solution of a chemical compound of a metal  $M_1$  and a chemical compound of a metal  $M_2$  an oxide of which does not dissolve in an oxide of said metal  $M_1$ ;

precipitating said oxide of said metal  $M_1$  or a precursor of said oxide of said metal  $M_1$  and said oxide of said metal  $M_2$  or a precursor of said oxide of said metal  $M_2$  or a chemical compound of said oxides or said precursors from said solution; and

then calcining said precipitate.

18. A method of producing said composite oxide powder recited in claim 10, comprising the steps of:

preparing an aqueous solution or water-contained solution of a chemical compound of a metal  $M_1$  and a chemical compound of a metal  $M_2$  an oxide of which does not dissolve in an oxide of said metal  $M_1$ , and a chemical compound of a metal  $M_3$  an oxide of which can dissolve in at least one of said oxide of said metal  $M_1$  and said oxide of said metal  $M_2$ ;

precipitating said oxide of said metal  $M_1$  or a precursor of said oxide of said metal  $M_1$ , said oxide of said metal  $M_2$  or a precursor of said oxide of said metal  $M_2$  and said oxide of said metal  $M_3$  or a precursor of said oxide of said metal  $M_3$ , or a chemical compound of said oxides or said precursors from said solution; and

then calcining said precipitate.

19. A method of producing composite oxide powder according to

claim 17, wherein hydrogen peroxide is added in obtaining said precipitate.

20. A method of producing composite oxide powder according to claim 17, wherein one of said precipitate of said precursor of said oxide of said metal  $M_1$  and said precipitate of said precursor of said oxide of said metal  $M_2$  is obtained prior to the other.

21. A method of producing composite oxide powder according to claim 17, wherein said precipitation is carried out by using neutralization reaction and it takes 10 minutes or more from the start to the end of said neutralization reaction.

22. A method of producing composite oxide powder according to claim 17, wherein said precipitate is aged in a suspended state in which water or a water-contained solution is a dispersion medium or in a state in which there is abundant water in a closed system consisting of said precipitation, steam and water.

23. A method of producing composite oxide powder according to claim 22, wherein said aging is carried out at or above room temperature.

24. A method of producing composite oxide powder according to claim 23, wherein said aging is carried out in the temperature range of 100 to 200 °C.

25. A method of producing composite oxide powder according to

